functional tasks of the NGO, their scope and affiliation would need to be greatly expanded in order to meet the rationale for an NGO. Several examples of CSC's are described below for reference.

3.7.2.1. Texas A&M University — Commercial Space Center for Engineering

This CSC, formally established by the Texas A&M University System Board of Regents, is dedicated to working with industry to generate engineering research and technology development projects to be conducted on the space station. As one of NASA's Commercial Space Centers, it along with its business partners merit preferred and low-cost access to space. It represents a one-stop-shop for spacecraft technology developers, providing expert technical support, simplified ISS integration, and business planning services.

3.7.2.2. BioServe Space Technologies

Bioserve Space Technologies is located at the University of Colorado in Boulder. The Center embodies affiliates from the commercial, academic, government and non-profit foundation sectors. BioServe concentrates its efforts in five areas. In the area of bioprocessing/bioproduct development, microgravity is used to foster the commercial development of new bioproducts for use in the human body and unique, commercially important bioprocessing techniques. Another area, physiological modeling in space, uses microgravity to explore changes that occur in living systems. Special emphasis is placed on using space as a unique laboratory to address terrestrial health concerns in ways that are not possible on Earth, and to address health issues that will be of concern to living organisms exposed to microgravity for long duration. Biomolecular electronics, the fourth area of research, uses microgravity to develop new "biocybernetic" materials for use in future computer systems. The fifth area, called enabling device capability, focuses on developing a suite of generic, flight-qualified and flight-proven devices that address the needs of a wide spectrum of life sciences investigators.

4. Objectives and Requirements

Section 2.2 introduced the rationale for adopting an NGO form for the ISS utilization management entity. Section 3 discussed various types of management structures. In this section, the elements of the rationale are examined, as well as other relevant organization requirements, as related to these various management structures in order to predicate metrics which will be useful in comparing them. This analysis will become the basis for establishing strengths and weaknesses for each option; these will be discussed in Section 5.

4.1. Examination of the Rationale

4.1.1. Minimizing Regulations

Federal regulations affect, in particular, contracting, purchasing, property management, human resources, marketing and accounting. They increase the overhead cost of an operation (of the order of several percent) due to the increased staffing levels required to enforce them. More importantly, they introduce delays in the business operation due to increased number of hand-offs or interfaces. These delays translate into schedule impacts that do affect the overall cost. The most common regulations arising with the acceptance and use of federal funds are the Federal Acquisition Regulations (FAR). A listing of the applicable FAR's as a function of the procurement value and type are given as Appendices B and C. For high dollar value procurements, time-consuming certifications introduce delays in the procurement and constraints limit flexibility. A recent development is the establishment of independent and agency-unique acquisition systems that ostensibly are set up to avoid the burdensome constraints of the FAR. The first example of this is the Federal Aviation Administration's Acquisition Management System. Table 4-1 lists the key code requirements for each of the NGO types along with those for a GO, for comparison purposes.

Table 4-1: Code Applicability

Private Corporation:
- State Corporation Laws
- Uniform Commercial Code
- Generally Accepted Accounting Principles
- Commerce and Trade Procedures (15 U.S.C.)

Independent Consortia or Institute:
- State Corporation Laws
- Generally Accepted Accounting Principles
- Commerce and Trade Procedures (15 U.S.C.)

Association and/or Cooperative:
- State Corporation Laws
- Generally Accepted Accounting Principles
- Commerce and Trade Procedures (15 U.S.C.)

Government Corporation:
- Government Organization and Administrative Procedures (5 U.S.C.)
  - -Less Freedom of Information Act
  - -Less Civil Service Rules regarding pay and tenure
- Government Corporation Control Act (31 U.S.C.)
- Commerce and Trade Procedures (15 U.S.C.)

State Agency:
- Code of applicable state, e.g., Maryland (COMAR)
- Code of Federal Regulations

NASA Institute:
- Public Contracts Procedures (41 U.S.C.)
  - Cost Accounting Standards
  - Federal Acquisition Regulations
  - NASA FAR Supplement
- Public Health and Welfare (42 U.S.C.)

NASA Division:
- US Code applicable to Federal Agencies

Government Organization and Administrative Procedures (5 U.S.C.)
- Freedom of Information Act
- Privacy Act
- Sunshine Act
- Inspector General Act

Money and Finance Procedures (31 U.S.C.)

Public Contracts Procedures (41 U.S.C.)
- Cost Accounting Standards
- Federal Acquisition Regulations
- NASA FAR Supplement

Public Health and Welfare (42 U.S.C.)

Applicable code constraints for various Government Corporations have been detailed in a GAO report[12] and will not be repeated here. In that report, one finds that there is flexibility in which Codes apply depending upon the terms in the enabling act. Of particular concern to the commercial user of ISS is the applicability of the FOIA, i.e., the concern for intellectual right protection. For some NGO's that are Government Corporations, a release is invoked from the FOIA based on the concept that data receivership by an NGO is not equivalent to agency information and thus is protected. Congressional approval of the waiver is required. This invocation is most likely applicable to the experiments, technology, and commercial development of ISS general users but must be examined regarding internal IR&D by staff. The detailed exemption granted by NASA regarding FOIA is given in Appendix D.

The following statutes are commonly applicable to NGO's receiving federal funding.

A. Economy Act: 31 USC Section 1535. Provides authority to Federal agencies for requesting and performing interagency reimbursable work. Under this authority, NASA's obligation authority expires when the customer agency's authority expires.

B. Anti-Deficiency Act**:** Title 31, U.S. Code, Sections 1341 and 1517 (principal provisions):
    a) Prohibits any officer or employee from making or authorizing an obligation in excess of the amount in an appropriation or in an amount permitted by agency regulations.
    b) Forbids the involvement of the government in any contract or obligation to pay money in advance of appropriations.
    c) Requires the head of each agency to issue regulations establishing an administrative control system with a dual purpose: first, to keep obligations within the amount of appropriations, and second, to enable the agency to fix responsibility for making obligations in excess of the apportionment.

4.1.2. Management Flexibility

An NGO can be established[13] in response to four different contractual instruments, viz., mandated by state or federal charter (or legislation), an "Other Transaction" (OT), a Cooperative Agreement, or a conventional procurement contract. Each instrument provides a different degree of management flexibility, say, in regard to personnel actions, restructuring to meet changing goals or opportunities, or making business agreements with

[12] " Profiles of Existing Government Corporations". Report to the Ranking Minority member, Subcommittee on Post Office & Civil Service, Committee on Government Affairs, U.S. Senate. U.S. General Accounting Office. B-259476. December 1995.

new affiliates. The financial and management aspects for the charter-based instrument have been described in Section 2 in which Government Corporations were discussed. This section focuses on the three remaining instruments with special attention give to the OT because of its high potential for achieving maximum financial and management flexibility.

4.1.2.1. Other Transactions

Financial flexibility applies both to how the NGO is funded as well as to what authority it has for distributing funds. A key issue is securing Government funding or subsidies without being encumbered by government-imposed accounting and procurement regulations regarding their use. One approach to accomplish this has been the use of contractual authority loosely defined in the 1958 Space Act, 42 U.S.C. § 2473 (c) (5), as "other transactions", a term coined by NASA General Counsel Paul Dembling.

DEFINITION OF TERMS

Procurement contracts are used when the principal purpose of the instrument is to acquire property or services for the direct benefit or use of the United States Government.

Assistance Agreements include grants and cooperative agreements, the principal purpose of which is to transfer something of value to the recipient in order to carry out the public purpose instead of acquiring property or services for the direct benefit or use of the United States Government.

Cooperative Agreements are used when the expected involvement of the agency is substantial. *Grants* are used when the expected agency involvement is essentially administrative.

4.1.2.2. NASA's Use of Other Transactions

Within NASA, Other Transaction authority has been used numerous times in the form of Memoranda of Understanding, Letter Agreements, and Nondisclosure Agreements - generically known as Space Act Agreements. An important variant is the Joint Endeavor Agreement (JEA) which has permitted commercial entities to use NASA resources (STS, laboratories, zero-g facilities, etc.) usually in exchange for NASA access to the commercial equipment. A more ambitious agreement was struck with the Orbital Sciences Corp. (through a Memorandum Of Understanding) to develop a transfer vehicle for lifting payloads into

[13] Throughout this study it is assumed that no single existing organizational entity will be adequate for the scope of the ISS utilization management particularly if both scientific and commercial interests are to be served. The formation of some hybrid management-operational entity is therefore presumed.

geosynchronous orbits from the Shuttle. In general, these OT's have limited applicability and narrow scope and relate to working relationships, allocation of responsibilities (and liability), and transfer of technologies.

4.1.2.3. DOD's Use of Other Transactions

The Department of Defense (DoD) formalized the use of Other Transactions as it began to privatize certain laboratories originally under its jurisdiction beginning in 1989. DoD's use is primarily throughout DARPA, its R&D organization. It is worth noting that the simplicity of DARPA's organization and relatively autonomous culture enables some of these freedoms. Hindered in finding innovative contractors with promising new technology that were willing to work under government procurement, DARPA concluded it needed flexibility in its approach to support advanced R&D. DARPA turned to NASA for inspiration. By authorizing DoD to use Other Transactions to fund research and development activities, Congress effectively exempted such research activities from the requirements of the Chiles Act. Agencies were given independent authority to enter into binding agreements that might include significant funding for the acquisition of goods or services, but were not subject to the formalities and cumbersome rules applicable by statute to procurement contracts. It is important to note that with its granting of flexibility, the Congress requires DoD to provide an annual report on the use of OT's. In addition, the enabling legislation applicable to the DoD involves an expiration clause in its OT arrangements.

Other Transactions are typically defined by what they are **not**. For example, the DoD enabling regulations call for DoD's use of the OT authority "only when the use of standard contracts or grants is not feasible or appropriate." DARPA followed, stating that an OT is "not a standard procurement contract, grant or cooperative agreement." Because of this definition, OT's are **not** subject to government procurement regulations or statutes. However, OT's are not exempt from all laws and regulations; they are subject to statutes and regulations that govern non-procurement activities. Certain statutes applicable to procurement contracts, cooperative agreements and grants may not necessarily apply to OT's. The statutes[14] applicable to procurement actions involving OT's are listed in Table 4-2.

4.1.2.4. Characteristics of OT's

The three categories for OT's are Research, Prototypes and other types of arrangements. The policy has been to use OT's to carry out research projects not appropriate or feasible by standard grants or cooperative agreements. Four factors that must be considered before issuance are the nature of the project, the type of

[14] "The Applicability of Certain Procurement-Related Statutes to DoD 'Other Transactions', a Project of the ad hoc Working Group on 'Other Transactions', Section of Public Contract Law, American Bar Association, Feb 10, 1999.

recipient, the recipient's agreement to cost share, and the government's official involvement. It should be noted that OT's attract firms that have not traditionally done business with the government due to the desire to avoid burdensome financial reporting, procurement, and intellectual property arrangements. Characteristics of OT's are flexibility, teaming of partners, cost sharing, and use of commercial business practices rather than FAR and DoD authorities.

- Flexibility applies in the application of particular statutes. For example, OT's also allow more flexibility in intellectual property arrangements.
- Teaming allows the agency to use consortiums of technology developers with government participants. The ability to freely work together and collocation contribute to OT success.
- Cost sharing reduces government costs and serves as a test of commitment and incentive to avoid waste, thus accomplishing the goals of the unutilized regulations. However, cost sharing is not essential in an OT.
- OT's require trust and flexible commercial-like business practices, and an honest business relationship, and expediency.

Cultural resistance to change is, of course, a barrier to use of OT's, and in DoD, training has been conducted to ease the problem. However, OT's do serve to enhance competitiveness and technical success. Since current legislation related to OT's restrict that instrument's use to R&D (or prototyping), legislative redefinition of OT's may be required in order to accommodate the new functionality associated with privatizing NASA operational functions.

Table 4-2 Applicable Regulations

	STATUTE	A	N/A
1	Competition in Contracting Act		X
2	Contract Disputes Act		X
3	Procurement Protest System		X
4	Extraordinary Contractual Authority And Relief	X	
5	Expenditure of Appropriations, Limitation	X	
6	Kinds of Contracts		X
7	Examination of records of contractor		X
8	Contracts, acquisition, construction, or furnishing of test facilities and equipment		X
9	Contracts; indemnification provisions		X
10	Prohibition against doing business with certain offerors		X
11	Major Weapon Systems: Contractor Guarantees		X
12	Prohibition on persons convicted of defense Contract related felonies and related criminal penalty as defense contractors		
13	Contractor employees; protection from reprisal for disclosure of certain information		X
14	Limitation on the use of appropriated funds to influence certain Federal contracting and financial transactions		X
15	Anti-Kickback Act		X
16	Procurement Integrity Act		X
17	Service Contract Act	X	
18	Walsh-Healy Act		X
19	Fair Labor Standards Act	X	
20	Drug-Free Workplace Act		X
21	Buy American Act		X
22	Tucker Act	X	
23	Bayh-Dole Act		X
24	Technical Data provisions applicable to DoD		X
25	Trade Secrets Act	X	
26	Freedom of Information Act	X	
27	Judgements, awards and compromise settlements	X	
28	Limitations on e pending and obligating amounts	X	
29	Administrative Remedies for False Claims and Statements	X	
30	Truth in Negotiations Act		X
31	Cost Accounting Standards		X
32	Cost Principles		X

4.1.2.5. Cooperative Agreement

An important contractual instrument, other than the common procurement contract, that can be used to define the relationship between NASA and the NGO is the Cooperative Agreement. As defined by 31 U.S.C. 6305, cooperative agreements are financial assistance instruments used to stimulate or support activities for authorized purposes and in which the Government participates substantially in the performance of the effort. There are two regulatory statutes: one for commercial entities and one for universities and non-profit organizations covered by 14 CFR Part 1260.

Cooperative agreements are ordinarily entered into with commercial firms to:

a) Support research and development

b) Provide technology transfer from the Government to the recipient

c) Develop a capability among U.S. firms to potentially enhance U.S. competitiveness.

In general, competitive procedures to award a cooperative agreement are preferred. Unsolicited proposals may be made but must evidence a unique and innovative idea or approach that is not the subject of a current or anticipated solicitation. A substantial resource contribution on the part of the recipient is required (at least 50% of the total resources required to accomplish the cooperative agreement). Less than 50% may be considered but must be warranted. If NASA resource contribution is $5 million or more, high level Government approval is required. Recipients shall not be paid a profit under cooperative agreements. Subcontractors however, may earn profit. The recipients cost share may be allocated as part of its IR&D program in accordance with a class deviation pursuant to 48 CFR (NFS) 1831.205-18. The Government's resource contribution may include non-cash items such as personnel, equipment, facilities, etc. In the case of the NGO, the in-kind contribution by NASA could be the exclusive allocation rights, or some fraction thereof, to ISS utilization.

Using consortia as recipients for cooperative agreements is encouraged. These may be comprised of Government organizations and commercial firms, which perform complementary functions. Use of educational institutions, small and small disadvantaged business is also valuable in ensuring the results of the consortia activities are widely disseminated. Participation by foreign firms is not precluded if the evaluation criteria are satisfied.

Title to inventions developed under the Cooperative Agreement is limited by Space Act of 1958 (42 U.S.C. 2457). NASA uses its best efforts to grant the recipient first option to acquire inventions. It should be noted that invention and patent rights are governed by the Space Act Agreement, which can be more flexible in the area of data rights. For large businesses, the Government is awarded title initially. The recipient has 30 days after discovery to request a waiver under patent regulations. Any recipient-developed invention to be commercially

licensed will be royalty bearing to the individual inventor (ex. Government employee-inventor). Since a Cooperative Agreement is governed by federal regulations, the recipient is offered various protections not otherwise available (ex. Cross waiver of liability clauses). License regulations are covered by the Federal Technology Transfer Act.

4.1.2.6. Procurement Contract

A procurement contract is a legal instrument reflecting a relationship between the government and a recipient where the principal purpose of the relationship is to acquire property or services for the direct benefit or use of the government (31 USC 6303). In the context of ISS utilization management, the simple procurement of these management services through a procurement contract could apply to a) commercial corporations and b) institutes such as the HST Science Institute, both not involving cost sharing. The use of a procurement contract is the traditional approach which entails the full gamut of regulations and constraints and will therefore not be discussed further.

4.1.3. Financial Flexibility

Financial flexibility derives from both a reduction in restrictive regulations and an increase in the possible sources of operational (and grant) funding. Table 4-3 lists representative funding sources for each of the NGO approaches.

Table 4-3 Sources of Funding

Funding Source	Gov Corp	GSE	State Agency	Coop	Consortium	NASA Institute	Cmmrcl Corp
User Fees	•		•	•	•	?	•
Government Grants	•	•	•		•	•	•
Private Endowments			•	?	•	•	
Royalties	•	•	•	•	•	•	•
Dues				•			
Taxes	•		•			Indirect	
Stock	•	•		•			•
Bonds	•	•	•		?		•

User fees could be used to recover some fraction of marginal operating costs for all options except the NASA Institute; amortizing development costs of the entire infrastructure for any option is unlikely due to the high cost of ISS and STS. These fees may be direct subsidies or grants from NASA or be charges levied against users

according to a service schedule not unlike that being used in the CSOC approach for mission operations. User's funds could be derived from grants made by NASA directly to the scientist or a company's IR&D pool in the case of commercial users. A special form of the fee could be a percentage charged against the profit for the direct and continuing commercial use of the ISS such as for advertising, souvenirs or other space-items. If the NGO were to be franchised for performing all, or a major portion of, experiment or payload integration testing, then this could become a significant source of funds to cover recurring costs and, possibly, create profit. The additional non-recurring cost for establishing this capability within the NGO would be offset by the long-term cost savings from efficiencies of using a single entity with accrued experience.

The majority of the management options discussed in this study are non-profit but this in itself does not allow tax-deductible contributions or endowment as a viable funding source. However, with appropriate enabling legislation, an associated NGO Foundation could be established having a 501 C (3) status with the objective of funding beneficial experiments while affording donors tax advantages.

A potentially significant funding source for all options are royalties garnered from the long-term commercial exploitation of products resulting from technology developed using the ISS. The terms for royalties would be established as part of either limited partnerships or user agreements made in advance of providing service to the user. They would not be applicable to government users. Royalties could serve as a source for grants or venture capital as well as defraying recurring operational expenses.

Dues are appropriate in the consortia or association option as a standardized means to subsidize the operation of the NGO. In this option, the signatory members are allocated some predefined access rights and service support according to terms established in the charter of the NGO. Non-signatory users can "purchase" temporary access and support services based on a "public" fee structure. As the ISS develops into a mature facility and risk of utilization declines, access to this limited resource will appreciate and so will the price of the access or tenancy rights. This appreciation is analogous to a capital gain in the commercial market, and thus provides more incentive for commercial firms to enter the initial endeavor.

Issuing either debt or equity instruments requires a credible return, which, in turn depends on the "profitability" of the NGO-ISS. By its nature as a facilitator providing a standardized service for a resource-limited facility, the NGO deals with a small customer base and has limited growth capability in terms of new services or features. It therefore offers limited return on investment, excluding the royalty potential, and any public or private investment would be more altruistic than profit seeking. As royalties accrue, this situation could change with the emphasis being in equity investment and the NGO assuming the role of a venture banker.

In any of the options, NASA would presumably enjoy major tenancy for ISS utilization, at least in the initial period, and thus provide a sizable subsidy for NGO operational funding directly or indirectly through grants to users. It remains to be seen whether similar tenants would be created by the initial user successes wherein blocks of ISS time would be procured for resale (at some profit to the original owner) or corporate use. Presumably some limitation would be imposed on member ownership – not unlike that for COMSAT. This approach to funding is most consistent with either the Cooperative Association or Consortium forms of NGO. In order to foster broad science and commercial application of the ISS, these members would need to be term limited.

4.1.4. Cost Reduction

Before attempting to impose solutions for the purpose of minimizing cost, it is first useful to establish root causes of excessive cost. These causes, once identified, then drive implementation requirements or metrics and an effective, efficient solution. This strategy applies equally well to either a GO or NGO implementation approach. It is assumed that there is some baseline cost related to the technical aspects which assures engineering worthiness and the desired performance of any proposed experiment. Additional costs accrue due to the business and/or management environment in which the experiment is acquired and utilized. Some are related to physical interface issues but most are due to socio-political-economic pressures. An informal cause-effect analysis for the issue of increased cost lead to the following root causes: risk of failure, concern for asset jeopardy, and overhead. In addition, a business "cost" was identified associated with schedule guarantee as well as a fifth cause, motivation, which is associated with the institution involved. These five cost drivers are discussed below.

4.1.4.1. Risk of failure

In the past, minimizing failure has been necessary because of the paucity of space opportunities and the political significance of being successful in space. Traditionally, it entails additional experiment analysis; testing and demonstration; redundant design with failover capabilities; frequent management review; and extensive documentation. All these requirements increase the overall price of the experiment without enhancing the science return. The ISS affords extended stays, possibility of experiment repair and, in the case of an experiment failure, reasonably easy repeat opportunity. Thus, independently of the management structure employed, the operational environment of the ISS already mitigates this risk factor. The degree of risk[15] to be adopted becomes more an experimenter trade decision weighing against the urgency of obtaining results versus the added cost of "overdesign". In the event that the management entity also conducts in-house

[15] It should be noted that schedule uncertainties and immature interfaces will keep this cost high initially.

experiments onboard the ISS, the degree of acceptable risk may be lower, and the cost therefore greater, in order to preserve its management and operator credibility.

4.1.4.2. Asset Jeopardy

Additional requirements are imposed on the experiment development process and design related to its failure modes and their potential for injury to either the delivery system (STS) or the space facility (ISS) and its operators (astronauts). The ISS, along with its crew, is an expensive asset which must be safeguarded. Users, employing the NGO as their agent, will be required to meet externally generated safety requirements which are significant cost driver. It is estimated that an attached Shuttle payload requiring little or no astronaut interaction involves a cost premium of 5%. This can grow to 20% for one requiring intensive interaction because of the more complex interface, safety, crew training, etc. As long as the user must interface through the NGO with government controlled assets, the STS and ISS; the added expense of "man-rating" of experiments to meet the safety requirement is unavoidable. Eliminating the interface by assigning responsibility for the ISS to the NGO would tend to reduce this cost but it can be mitigated in other ways as well. Using the Shuttle attached payload program as an example, a gradual relaxation of requirements with the consequent reduction in this expense can occur with a growing experiential base. Thus costs could be reduced by using the most experienced experiment integrator who provides consultation at all phases of experiment development, whether a GO or NGO, and by providing the crew for operating the experiment. This does argue that independently of the type of management structure, long-term continuity is important in order to build payload operator/integrator confidence and accumulate experience.

4.1.4.3. Overhead

Overhead is here defined as charges levied against the experiment by the NGO (or GO) to cover its "expense" of doing business but not necessarily in direct support of the experiment. These costs appear to the user as increased usage charges or, for a zero-sum federally funded NGO or a GO, reduced available experiment funding. The first, and most obvious, step is to minimize staffing and procedures related to unnecessary regulations. A second is to utilize existing facilities, if possible, rather than creating special ones, particularly for simulations, testing and integration. A third step is to constrain the management entity by terms in its charter to focus all of its activities to be in direct support of experiments and their operation. The exception is when these activities result in a net financial return by promoting increased commercial usage of the ISS.

4.1.4.4. Schedule Guarantee

A serious business issue can arise if the "owner" of the asset (ISS) is free to alter mission priorities and schedules for its own purposes independently of the utilization plan. This conflict could occur if the ISS is a shared facility with some functions or activities conducted outside the scope of the NGO-managed utilization.

Particularly for commercial endeavors, the decision to undertake a development project depends on the timeliness (or unpredictability) of bringing the product through its development phase to market. The inability to obtain schedule assurance can dissuade participation. One can consider delay as a "cost" that affects the profitability of the development and, consequently, needs to be minimized. One solution to this issue is for the NGO to have prenegotiated guaranteed access rights independently of other ISS activities, excluding emergencies, or to be given control of all activities onboard the ISS. Furthermore, in order to reduce the perceived schedule risk, the NGO could provide users with indemnification for lost access albeit at the expense of increased overhead cost for the sake of making the ISS more commercially attractive.

4.1.4.5. Motivation

The last consideration which applies to cost reduction is motivation. In some management options there may not be incentive to control or reduce cost. Government organizations are often motivated to maintain spending levels rather than reducing them in order to protect future year budgets or to provide contingency resources. But for the most part, GC's and the more public forms of NGO's are exempt from use-or-lose funding rules. They can consequently be motivated to reduce costs and use the recovered funds for the purposes of reinvestment to expand the scope of service or reduce user fees. Freedom from use-or-lose funding regulation is therefore an important feature for an NGO. A for-profit variant of an NGO, as with any commercial firm, could be expected to routinely address cost reduction (and increased quality) in order to maximize profit. Mixed ownership GC's supply motivation through equity asset appreciation. Cost incentive, performance based procurement contracts can provide motivation if cost control is a metric (although the sponsoring Agency may be unmotivated to use this). In any option, the approach benefits from having a "reward" for any cost savings.

4.1.5. Liability and Indemnification

4.1.5.1. Legislative Basis

This section highlights the complexities associated with liability and indemnification which could or will arise in the use of an independent or privatized entity managing ISS utilization.

Any private or commercial endeavor involving the use of space requires arrangements regarding liability in regard to the home nation and among nations (and multi-national organizations). The former is normally accomplished using some form of an agreement while the latter is addressed by International treaties and space law[16], specifically the UN Outer Space Treaty of 1967. Under the Space Act, 42 USC Sec 2473, the Administration was authorized to act on claims for $25,000 or less for bodily injury, death, or damage to or loss

[16] Some material was excerpted from American Space Law, 2nd Edition, N.C. Goldman. 1996.

of real or personal property resulting from the conduct of the Administration's functions. Larger claims require Congressional approval.

In order to foster commercial participation in space programs, NASA has been authorized by Congress to extend cross-waiver of liability to its contractor and subcontractors. This waiver applies to 1st and 2nd party liability, i.e., each party to the agreement bears his own risk and not the total risk of the venture. Cross-waivers apply to the parties of the agreement only. Note that no waiver denies the right of an individual, i.e., a 3rd party, to make a claim. Each entity must agree to these terms contractually. In regard to Space Station activities, NASA contractors and subcontractors are protected, excluding injury or death, but in the exercise of this authority, Congress requires NASA to establish safety plans and reviews to ensure, to the maximum extent possible, that payloads pose no safety risks for the ISS. This protection has been extended into protected space operations, a term which broadly covers all phases of an experiment except those processes for further product development following Earth return, as of July 1994. An important exception are claims related to intellectual property.

Indemnification regarding injury or property loss claims is a separate but important issue that relates to 3rd party type liabilities. These can arise in the life cycle from experiment development, through integration and test, to operation aboard the ISS. Originally, to promote space activities with a reasonable risk framework, the NASA Space Act, Section 308 provided for government assumption of 3rd party liability for claims in excess of commercially available insurance limits. As amended later, Sec. 308 requires Shuttle users to purchase 3rd party liability insurance up to $500M with NASA assuming responsibility for claims in excess of this. NASA, in October 1997 and then in March 1998, requested a further extension of the indemnification to the newer arrangements (Other Transactions, cf. Section 3.1.2.1) being used by NASA in partnership with industry. It should be noted that this extension request is explicitly focussed on domestic R&D programs and excludes international activities such as joint programs involving the ISS.

4.1.5.2. Liability Implications for the NGO

Liability considerations depend on the functional responsibility allocated to the NGO. In the following, the functionality listed in Appendix A (Work Breakdown Structure) is assumed. Four features of the NGO make it distinctly different from a traditional commercial contractor in regard to the current liability provisions discussed above.

The NGO could:

- Be created using a non-procurement contract and is relatively independent of NASA

- Be involved not only in facilitating R&D but also commercial enterprises (from which it may derive financial benefits),
- Serve as a participant in the development aspects of payloads and experiments,
- Share authority for ISS utilization with other international agencies and depends upon the NASA controlled STS to accomplish its responsibilities to users.

The use of the Other Transaction[17] authority to establish an NGO would not be covered by the usual government indemnification for tort liability[18] to 3rd parties. Under International Law, both the launch provider and procurer are held liable for damages to a blameless third party. In the context of the NGO, with NASA controlling both the STS and ISS, an independent NGO may be considered the procurer for NASA services and is thus reciprocally liable. In these cases, the NGO cost for liability insurance could be excessive. To overcome this, the NGO will require special dispensation through indemnification provisions in its charter for a Government Corporation or agreement for an OT-acquired entity. Since the marketability of ISS resources is proscribed by the availability of launch resources and the physical growth limitation of the ISS itself, an NGO's revenues are constrained and it would not be capable of bearing the high cost of insurance unless it passes this cost on to the user. If the NGO takes the form of a Government Corporation, it could be considered an entity of the Federal government and, as such, qualify for the general indemnification and liability protection afforded other agencies. This would be valuable if, in the future, the control of the ISS were transferred over to the NGO thereby privatizing the entire space station enterprise.

The Getaway Special (GAS) program requires experimenters to purchase their own insurance (or bear the risk) for space-related accidents because NASA considers itself immune. This and similar programs has resulted in extensive legal packages under the objective of fostering commercial uses of space. For the Rapid Spacecraft Acquisition program at GSFC, NASA assumes no liability until acceptance and requires developers to acquire insurance during the development phase. If the NGO serves to provide integration and test, simulation, and training services to users of the ISS, then it may be considered part of the development process and with that assumed, there is an implied responsibility for liability in the development of the experiment. This, in turn, requires the NGO to participate or acquire directly liability insurance unless specifically waived as part of the contract between NASA and the NGO.

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[17] This matter is discussed by Mr. Rising, Lockheed Martin, in the Hearing on Indemnification & Cross-Waiver Authority before the Subcommittee on Space & Aeronautics of the House Committee on Science, Oct 30, 1999. The discussion focussed on the lack of government indemnification due to the use of a Cooperative Agreement (Other Transaction) for the development of the X-33.

[18] Tort law relates to injury or damage due to negligence not related to breach of contract.

Aside from its participation in experiment development functions, the NGO may be considered at the same time an agent of the user in dealing with NASA regarding accommodations, schedules, and (launch) delivery aspects of the enterprise. In this capacity, the question of indemnification from consequential and collateral damage arises in the handling of the experiment. Terms of agreement with the user, similar to that invoked by commercial suppliers of products, will be needed to waive liability. On the other hand, if the NGO's objective were to "promote" commercial use of the ISS, it would be better served to be able to extend 2nd party liability regarding the services it offers to the user as an agent. In this case, the user would have redress to cover business losses or reduce risk in the planning of a commercial enterprise against denied access to the ISS. Currently, such assurance is not provided except through queuing and bumping provisions stipulated in user agreements regarding the Shuttle.

4.1.5.3. Summary

The nature of the NGO implementation is somewhat different from the majority of the cases addressed by liability legislation since this legislation deals with commercial entities interacting with NASA while the NGO is more the privatization of a traditional NASA function. It will therefore require special legislative considerations and new agreement provisions with users.

5. ANALYSIS

5.1. Implementation Paths

Figure 5-1 summarizes the principal NGO implementation strategies discussed in this study. They are characterized by a) the process or path for establishing the NGO and b) the final form or type of NGO. The paths may involve competitive (Comp) or non-competitive (Non-Comp) acquisition processes. The latter usually involves, additionally, the need for enabling legislation by the Federal or a State government. The three principal contractual instruments, which define the relationship between NASA and the NGO and establish the NGO's responsibilities, are: procurement contracts, cooperative agreement, and Other Transactions Presumably the NGO, regardless of type, would then use conventional procurement instruments to acquire support services and specialized skills. Under certain state statutes, services could be offered as payment for stocks in the NGO enterprise. These NGO contractual activities will not be discussed here but could cover operations personnel, software maintenance, logistics support, engineering analysis, integration and test specialists, etc. The path labeled IA represents the standard NASA procurement approach and is not discussed below; the more flexible quasi-GO approach involving either a procurement contract or a cooperative agreement to form a NASA institute is shown as path IB. It should be noted that only a minor difference exists between the paths designated as IC and II since, in both cases, a form of an OT is used. The main distinction is that by using the enabling legislation to establish the NGO, its charter can be tailored to